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In the spring-summer months of 1960-1963 while working with personnel of the Anti-Epidemic Department of the Ministry of Public Health of RSFSR (Dir.: V. V. Kucheruk), we studied birds in a natural tickborne encephalitis focus in the area south of Kirov Oblast (Malmyzhsk district). Most observations were made at a permanent field station located in the middle of a linden fir forest occupying an area of about 40 km^2. This area is part of the South European taiga spruce forest. Owing to timber-felling exploitation during the last 10 years, much of the area surrounding the field station consists of cleared spaces.

The aim of this investigation was to determine possible participation of birds in maintaining an epizootic process within a natural focus. For this purpose it was necessary:

1) to study the specific composition, number, and distributional features of birds (chiefly of the most probable hosts of the taiga tick**), and also to demonstrate rules governing fluctuations of ornithopopulation in forests influenced by timber-felling and subsequent overgrowth of cleared spaces;

2) to evaluate the frequency of contact between birds and different arthropod groups, and to elucidate the significance of birds as hosts of larvae and nymphs of the taiga tick;

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** Presumably refers only to Ixodes persulcatus (H. H.).

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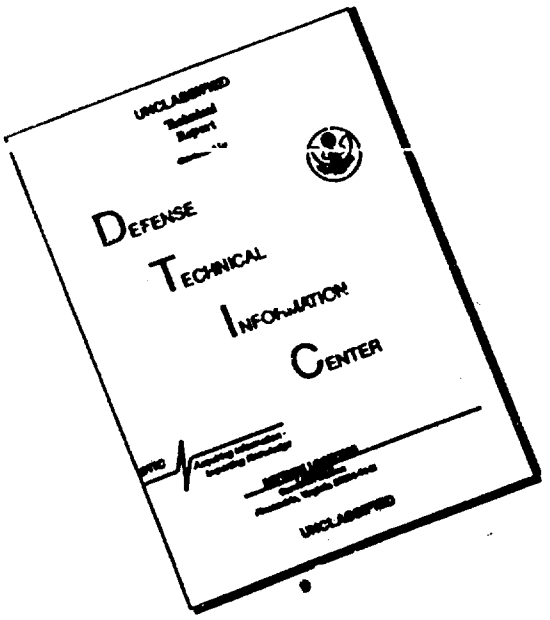

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3) to determine the extent of bird contact with tickborne encephalitis virus. This is one of the most important indices of their possible participation in the virus circulation process. For this purpose observationssof a more meticulous nature were necessary, associated particularly with development of more effective methods of recording absolute counts of bird (ixodid tick hosts) numbers as well as development of methods for trapping live birds in order to obtain their blood sera.

In this article an account is given of the chief results obtained during this investigation.

It is known that in all natural tickborne encephalitis foci where Tetraonidae sp. are found, these birds are heavily infested by ixodid larvae and nymphs.

Count findings of these vertebrates are included in the zoological work program in a natural focus, as recommended in existing "Temporary methodologic instructions". Accurate and easy counting methods for Tetraonidae have not, however, been developed. Our observations showed that when studying a stationary focal territory, data on absolute numbers and distribution of Tetraonidae may easily be obtained without employing special counting methods while carrying out other field, zoological, and parasitological investigations. Single birds and broods found should be marked with special symbols on a large scale map or plan of the field station. From regular inspection of different sectors of the field station by a zoologo-parasitological group, and accurate recording of information on birds found, a map showing absolute bird numbers and precise distribution of Tetraonidae sp. may be prepared. After a specially conducted comparison of various counting techniques, we recommend that of estimation of absolute numbers*. By recording the number of forest Tetraonidae species found, this method may be applied on a wide scale for study of natural tickborne encephalitis.

After making counts of Tetraonidae and small birds for several years in selected permanent areas in the taiga and in sites of timber-felling of various tree species, it was demonstrated that a relative stability of the most numerous bird species was observed in areas of intensive timber-felling exploitation. Following reduction of forests by timber-felling, a complete reorganization occurred in the ornithopopulation in such areas. Birds that nested in forests disappeared almost completely and cleared timber-felled areas became populated by other bird species. The number of species in the fauna in recent timber-felling sites is considerably poorer than in the original forest, and the population density of small birds in cleared

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* Absolute numbers serve to estimate the actual number of birds per unit of area and reflect the true size of their population.

timber-felled areas is approximately one-third that of the taiga. When the felled sites gradually become overgrown, the passerine population density remains approximately at the same level while the number of other bird species changes considerably.

Considering only possible larval and nymphal hosts, the greatest total bird population density can be observed from the 4th to 6th year of timber-felling existence.

Over 2,000 birds belonging to 65 species were subject to parasitological examination. Regular shooting of birds in the field station area permitted us to prepare a distribution map of infested tree pipits, pine buntings, and Tetraonidae sp. on which larvae and nymphs of the taiga tick are most frequently encountered in Kirov Oblast. The data obtained were compared with data on the number of small mammals collected over several years (Tupikova et al., 1963). It was demonstrated that there is no distinct relationship between rate of infestation of birds by different tick species and fluctuation in numbers of small mammals. The varying infestation rates of birds by taiga tick larvae and nymphs is determined by abundance of ticks in nature. The infestation rate of birds varies in different areas and is associated with irregular distribution of ticks throughout the territory. Data of many years on seasonal parasitism of larvae and nymphs on birds by season, information on distribution of infested birds, and maps compared with distribution of all developmental stages of the taiga tick (Zemskaya, Suvorova, 1962; Zemskaya, 1963; Suvorova, et. al., 1963), proved that birds do not play a conspicious role in the redistribution of ticks in the surveyed territory and cannot form or substantially contribute to formation of new areas with high tick numbers.

Unauthentic results of serological tests on extracted internal organs of animals (Andonov, 1959; Kondrashova, 1962), and the impossibility of obtaining sufficient amounts of serum from shot small birds, made it necessary to develop an effective method for trapping live birds in great numbers. Using automatic traps and trapping tactics developed by us (Korenberg, 1963), we were able, in a very short period, to take blood from a considerable number of small forest birds. A total of about 500 sera from more than 40 species was analyzed. Hemagglutination inhibition was used as a basic serologic reaction. It was demonstrated that this reaction is the most practical for conducting mass serological investigations of birds (Pchelkina and Korenberg, in press). There is, however, no distinct relationship between the rate of contact between different bird species and ectoparasites, and antibody frequency in their sera. The blood serum of certain bird species may probably contain nonspecific inhibitors that cause hemagglutination inhibition. Before the hemagglutination inhibition reaction may be applied on a large scale for epizootological investigation of tickborne encephalitis foci, though commenced by some authors (Votyakov and Egorova, 1962), it is necessary to verify further the specificity of this reaction on blood sera of wild birds and mammals of different species.

The data collected show that in Kirov Oblast taiga tick larvae and nymphs are regularly found on 8 or 9 bird species. Abundance indices of ticks on tree pipits and pine bunting (birds most frequently attacked by larvae and nymphs), only increase during certain years. The density of the bird tick host population remains disproportionately lower than the density of the small mammal population even during the period of low murine rodent density. There was a positive hemagglutination inhibition reaction in about 10% of sera obtained from birds. These facts are confirmed by our previous investigations (Korenberg, 1961; 1962), based on analysis of literature data, that birds play an insignificant role as hosts of ixodid ticks and virus circulation in eastern European natural foci of tickborne encephalitis.